

# Raspberry Pi 3 Boot to USB

This is taken from the following URL: <https://www.raspberrypi.org/documentation/hardware/raspberrypi/bootmodes/msd.md>

I have documented it here as I use this guide a lot, and I don't want to lose it :)

```
This tutorial explains how to boot your Raspberry Pi 3 from a USB mass storage device such as a
flash drive or USB hard disk. Be warned that this feature is experimental and may not work with
all USB mass storage devices.
<color red>USB Hard Drives seem particularly fussy.</color>
```

## Program USB Boot Mode

Before a Pi will network boot, it needs to be booted with a config option to enable USB boot mode. Enabling this config option requires special `start.elf` and `bootcode.bin` files. These can be installed by using the "next" branch on `rpi-update`.

Go to the [Downloads](#) page and install Raspbian onto an SD card using `Win32DiskImager` if you are on Windows, or `dd` if you are on Linux/Mac. Boot the Pi.

First, prepare the `/boot` directory with experimental boot files

```
If on raspbian lite you need to install rpi-update before you can use it:
```

```
sudo apt-get update; sudo apt-get install rpi-update
sudo BRANCH=next rpi-update
```

Then enable USB boot mode with this code:

```
echo program_usb_boot_mode=1 | sudo tee -a /boot/config.txt
```

This adds `program_usb_boot_mode=1` to the end of `/boot/config.txt`. Reboot the Pi with `sudo reboot`, then check that the OTP has been programmed with:

```
vcgencmd otp_dump | grep 17:
17:3020000a
```

Ensure the output `0x3020000a` is correct.

If you wish, you can remove the `program_usb_boot_mode` line from `config.txt` (make sure there is no blank line at the end) so that if you put the SD card in another Pi, it won't program USB boot mode. You can do this with `sudo nano /boot/config.txt`, for example.

**NOTE** - If you use the SAME boot SD Card each time to make a bootable disk, you only need to perform the steps above ONCE

## Prepare the USB storage device

Now that your Pi is USB boot-enabled, we can prepare a USB storage device to boot from. Start by inserting the USB storage device (which will be completely erased) into the Pi. Rather than downloading the Raspbian image again, we will copy it from the SD card on the Pi. The source device (sd card) will be `/dev/mmcblk0` and the destination device (USB disk) should be `/dev/sda` assuming you have no other USB devices connected.

We will start by using `Parted` to create a 100MB FAT32 partition, followed by a Linux ext4 partition that will take up the rest of the disk.

```
sudo parted /dev/sda
```

```
(parted) mktable msdos
Warning: The existing disk label on /dev/sda will be destroyed
and all data on this disk will be lost. Do you want to continue?
Yes/No? Yes
(parted) mkpart primary fat32 0% 100M
(parted) mkpart primary ext4 100M 100%
(parted) print
Model: SanDisk Ultra (scsi)
Disk /dev/sda: 30.8GB
Sector size (logical/physical): 512B/512B
Partition Table: msdos
Disk Flags:
```

Number	Start	End	Size	Type	File system	Flags
1	1049kB	99.6MB	98.6MB	primary	fat32	lba
2	99.6MB	30.8GB	30.7GB	primary	ext4	lba

Your **parted** print output should look similar to the one above.

Create the boot and root file systems:

```
sudo mkfs.vfat -n B00T -F 32 /dev/sda1
sudo mkfs.ext4 /dev/sda2
```

Mount the target file system and copy the running raspbian system to it:

```
sudo mkdir /mnt/target
sudo mount /dev/sda2 /mnt/target/
sudo mkdir /mnt/target/boot
sudo mount /dev/sda1 /mnt/target/boot/
sudo apt-get update; sudo apt-get install rsync
sudo rsync -ax --progress / /boot /mnt/target
```

Regenerate ssh host keys:

```
cd /mnt/target
sudo mount --bind /dev dev
sudo mount --bind /sys sys
sudo mount --bind /proc proc
sudo chroot /mnt/target
rm /etc/ssh/ssh_host*
dpkg-reconfigure openssh-server
exit
sudo umount dev
sudo umount sys
sudo umount proc
```

Edit **/boot/cmdline.txt** so that it uses the USB storage device as the root file system instead of the SD card.

```
sudo sed -i "s,root=/dev/mmcblk0p2,root=/dev/sda2," /mnt/target/boot/cmdline.txt
```

The same needs to be done for **fstab**:

```
sudo sed -i "s,/dev/mmcblk0p,/dev/sda," /mnt/target/etc/fstab
```

Finally, unmount the target file systems, and power the Pi off.

```
cd ~
sudo umount /mnt/target/boot
sudo umount /mnt/target
sudo poweroff
```

Disconnect the power supply from the Pi, remove the SD card, and reconnect the power supply. If all has gone well, the Pi should begin to boot after a few seconds.

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## NOTE

Once you have done a couple, and you are comfortable with the sequence, you can copy and paste the commands in batches:

```
sudo mkdir /mnt/target
sudo mount /dev/sda2 /mnt/target/
sudo mkdir /mnt/target/boot
sudo mount /dev/sda1 /mnt/target/boot/
sudo apt-get update; sudo apt-get install rsync
sudo rsync -ax --progress / /boot /mnt/target
```

```
cd /mnt/target
sudo mount --bind /dev dev
sudo mount --bind /sys sys
sudo mount --bind /proc proc
sudo chroot /mnt/target
rm /etc/ssh/ssh_host*
dpkg-reconfigure openssh-server
```

exit

```
sudo umount dev
sudo umount sys
sudo umount proc
```

```
sudo sed -i "s,root=/dev/mmcblk0p2,root=/dev/sda2," /mnt/target/boot/cmdline.txt
sudo sed -i "s,/dev/mmcblk0p,/dev/sda," /mnt/target/etc/fstab
```

```
cd ~
sudo umount /mnt/target/boot
sudo umount /mnt/target
```

sudo poweroff

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